PATENT SPECIFICATION 927,917

DRAWINGS ATTACHED.

927,917

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International Classification: —B23p (B23k, E04c).

COMPLETE SPECIFICATION.

Improvements in Welded, Three-Dimensional Lattice Girder Consisting of Rod-Like Members.

I, Ernst Cvikl, an Austrian Citizen, of 23, Wickenburggasse, Vienna VIII, Austria, do hereby delcare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed to be particularly described in and by the following statement :—

This invention relates to welded three-dimensional lattice girders consisting of rod-like members, which do not all lie in a common plane.

Such girders, particularly girders of triangular cross-section, are known and these are generally made by bracing the several bar members to form the finished three-dimensional girder and great difficulties are involved in quantity production and automatic production of these girders. For instance, the known triangular lattice girders are made with frames which surround the framing members and the lattice members (German Patent No. 822,154), with a pyramid-shaped arrangement of the lattice members, which are connected to the framing members (German Patent No. 888,762), with triangular plates having opertures for the framing members (German Patent No. 890,860), with V-shaped frames and cross-bars which connect the lattice members and the framing members (British Patent No. 725,952) or with other firm connections between the parts of the structure e.g., with sleeves (British Patent No. 614,171), gusset plates (British Patent No. 693,945), or with rivets (French Patent No. 596,831). More or less complicated equipment is required in these causes to assemble the three-dimensional structures in the shop. The transport of the finished three-dimensional lattice girders to the place where they are used involves further difficulties and also high cost.

The object of the invention is substantially to simplify and reduce the cost of the manufacture of such lattice structures. The invention resides essentially in that a lattice girder is provided which is made up of at least three individual substantially flat braced panels bounded by longitudinal members which are welded together. This design enables the several panels of the lattice girder to be made on a flat table by welding the longitudinal members and the bracing or lattice members if desired by automatic resistance welding, and in a second operation these separately made flat panels can then be brought together to form a girder of the desired cross-sectional shape after which the longitudinal members of adjacent panels are welded together. The welded seams which connect the panels to form a lattice girder may also be automatically formed. The panels can be combined by simple means on the site where the lattice girder is to be used so that great savings in transport space result owing to the covenience of storing panels. Even if the three-dimensional lattice girders are completely made in the factory the prefabrication of the panels will result in a much simpler method of manufacture, which can be adapted for automation. The division of the three longitudinal members previously usual in most cases and lying each at one corner of the triangular cross-section into six members, as is required by the manufacture of the panels, has the advantage that the individual rods may be smaller in cross-section even to an extent such that their diameter approaches that of the lattice bars. This is a great advantage for the automation of the welding operation because rods which are equal or approximately equal in diameter are easier to weld because equal stresses are set up in the rods on cooling whereas a satisfactory weld is more difficult to obtain

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in the case of unequal diameters. The subdivision of the members is unimportant for sections subjected to tensile stresses because in such cases only the actual total cross-sectional surface area matters. From a material supply point of view a subdivision is of advantage in the case of large girders because large diameter bars are more often difficult to obtain and are proportionately more expensive than bars of smaller diameter. In the case of bars subjected to compressive stresses and bending the subdivision of the bars into two parts according to the invention permits the modulus of the double bar obtained to exceed that of the single one.

The materials suitable for making the panel-type lattice girder according to the invention include steel, aluminium, plastic and any other weldable material. Likewise, all known bar-section members such as round-section bars, square-section bars, rectangular section bars or hexagonal-section bars which may be solid or hollow, may be used for making the panels. The section members may be used in a mixed arrangement, using e.g. hollow sections for the longitudinal members and solid sections for the bracing or lattice work.

Several embodiments of the invention are shown by way of example in the accompanying drawings :—

Figs. 1 to 4 are sectional views showing lattice girders having traingular cross-sections and consisting of bars ;

Fig. 5 shows on a larger scale the corner connection between two adjacent panels ; and

Fig. 6 shows the connection of the bar elements of a panel with the aid of welding electrodes.

In Figs. 7 to 12 the panels to be connected to form a three-panel lattice girders are shown one beside the other in their relative position before they are connected ; and

Figs. 13 and 14 show masts, radio towers or the like as can be made by combining panels according to Fig. 11 in a lattice girder.

The lattice girder shown in Fig. 1 is composed of three flat lattice panels each of which consists of two equidistant longitudinal bars 2 connected by lattice bars 1. All the bars are of round cross-section. To make the "ladders" panels the bar members 2 and lattice bars which may be of a zig-zag-, wave- or N-shaped formation, are connected first. This may be made automatically owing to the simplicity and regularity of the sequence of the welding points. In another operation the panels disposed with their members 2 in the position shown in the drawing may be interconnected by means of continuous or interrupted welded seams, as is shown on a larger scale in Fig. 5, where the welded seam connecting the panels is designated 3. The welding points between the ribs 2 and lattice bars 1 are designated 4. Owing to the ready accessibility of the joint the welded seam 3 may also be made automatically. Due to the similar design of all three panels the resulting lattice girder is in the form of an equilaterial triangle in cross-section.

The example shown in Fig. 2 corresponds substantially to Fig. 1 but the bars 1 are tubular and the members 2 of the upper panel are spaced more closely than those of the two other panels, which are similar to each other. As a result the cross-section of the lattice girder takes the shape of an acute-angled isosceles triangle.

The three-panel lattice girder according to the invention as shown in Fig. 3 is an embodiment in hich the members 2 of all three panels are unequally spaced. For this reason the lattice girder has the shape of an irregular trinagle in cross-section. In a specific case the mainly suitable for use as a purlin, the inclination of the panels conforming to the inclination of the roof. Two lattice girders which are right-angled in cross-section may be combined to obtain a lattice girder which is rectangular or square in cross-section. Lattice girders having any other desired shapes in cross-section may also be made.

In the example shown in Fig. 4 the ribs 22 of the panels have hexagonal section. This is particularly favourable for obtaining a three-dimensional lattice girder having an equilateral cross-section.

The lattice bars 1 between the members 2 may be flattened at the points where they are connected to the members 2, as is apparant, e.g., from Fig. 6. This enables a particularly favourable approach of the welding electrodes 5.

In the embodiments shown in Figs. 7 and 8 the bars 1 are arranged in zig-zag form so that the joints with the members 2 are equally spaced and lie in the same cross-sectional planes in the embodiment illustrated in Fig. 7 the zig-zag lattice bars of the lateral panels of the lattice structure are in registry when viewed in side elevation, whereas they cross each other in the embodiment shown in Fig. 8.

In the embodiment shown in Fig. 9 the intermediate panel is provided with lattice bars in an N-shaped configuration whereas the two other panels have lattice bars in a zig-zag configuration defining a member of fields which is half that of the intermediate panel. This arrangement is particularly advantageous if the intermediate panel lies in the compression zone.

In the example shown in Fig. 10 all three panels have lattice bars in N-shaped configuration.

Whereas in the embodiments described by way of example above the members 2 of the panels are parallel to each other, they

converge in one direction in the example of Fig. 11. Such panels combined to form a lattice girder are particularly suitable to form masts, radio towers and the like, as is apparent from Figs. 13 and 14.

In the embodiment shown in Fig. 12, e.g., the outer ribs of the two side panels are of segment shape so that the assembly results in a double tapered girder.

The invention is not restricted to the embodiments shown and permits of various modifications in design, assembly and application within the scope of the claims.

WHAT I CLAIM IS :—

1. A welded three-dimensional girder, comprising at least three substantially flat lattice panels, each of which consists of longitudinal framing members of rod-like material and connecting members welded to said framing members, and in which complete lattice panels are pre-formed and then assembled by welding together the framing members of adjoining panels.

2. A three-dimensional lattice girder according to Claim 1, in which the longitudinal framing members are interconnected by connecting members in the form of lattice bars arranged in zig-zag or wave-shaped form, which lattice bars are welded to the longitudinal members.

3. A three-dimensional girder as claimed in Claim 1 wherein two of the panels are each curved along one edge and are straight along the other edge, the structure being formed by welding together the curved edges of said panels and said structure being completed by a third panel having straight parallel edges which are welded to the straight edges of the said two panels.

4. A three-dimensional lattice structure, substantially as described hereinbefore with reference to and as shown in any of Figs. 1 to 4 and 13 and 14, with or without the modifications described with reference to and shown in Figs. 5 and 7 to 12 of the accompanying drawings.

WHEATLEY & MACKENZIE,
17 Wilson Street,
London, E.C.1.
Chartered Patent Agents,

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Published at The Patent Office, 25, Southampton Buildings, London, W.C.2,
from which copies may be obtained.

FIG. 1

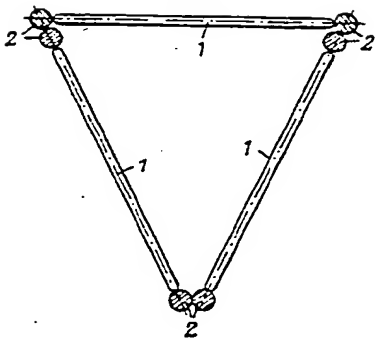


FIG. 4

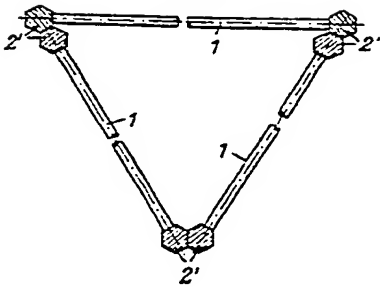


FIG. 2

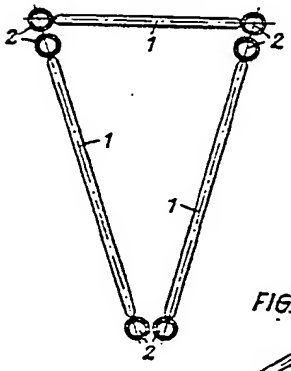


FIG. 5

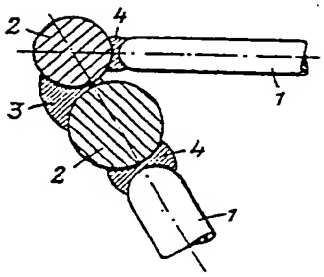


FIG. 3

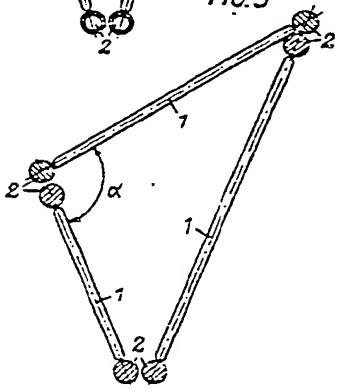
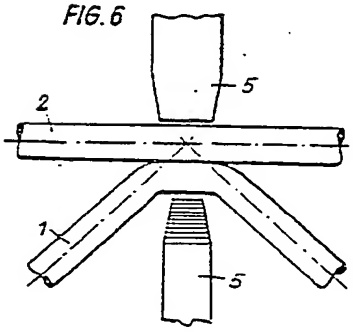


FIG. 6



927917 ◆ COMPLETE SPECIFICATION

2 SHEETS

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Sheets 1 & 2

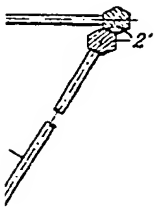


FIG. 7

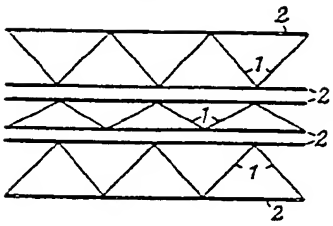


FIG. 9

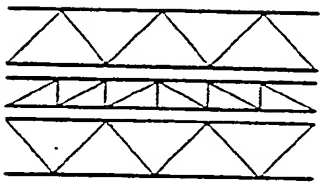


FIG. 13

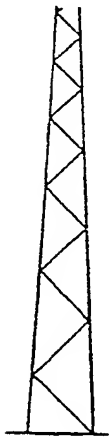


FIG. 8

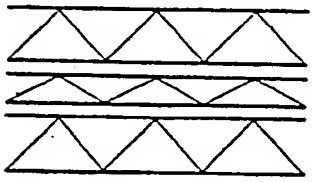
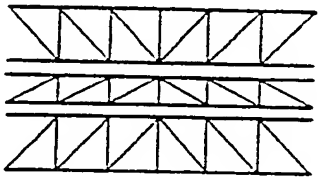


FIG. 10



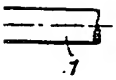


FIG. 11

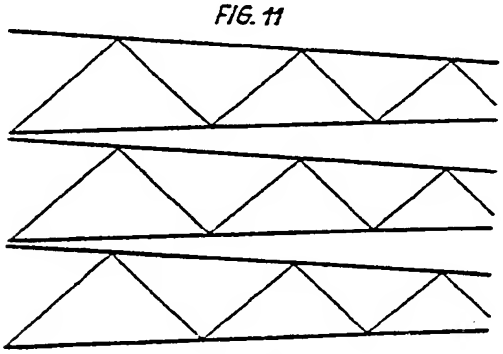


FIG. 14

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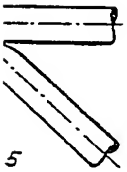
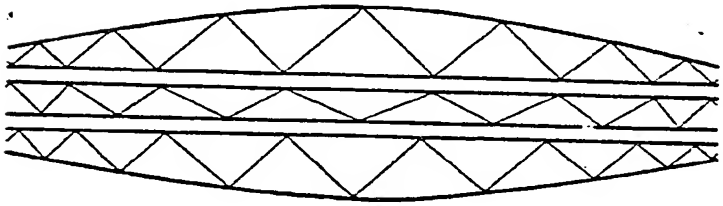


FIG. 12



927917 COMPLETE SPECIFICATION

2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheets 1 & 2

FIG. 1

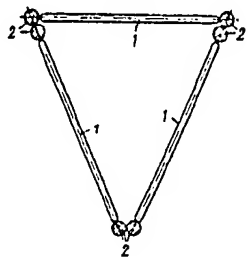


FIG. 2

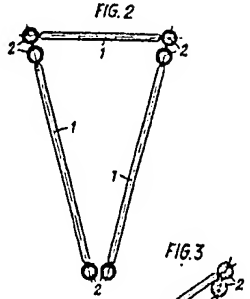


FIG. 3

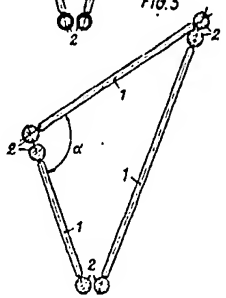


FIG. 4

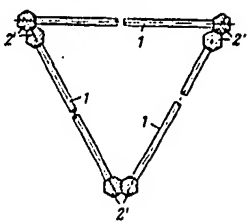


FIG. 5

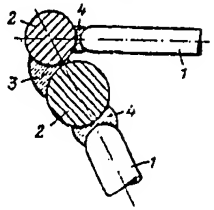


FIG. 6

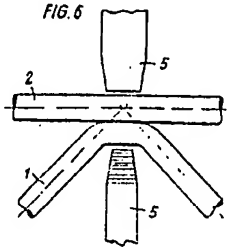


FIG. 7

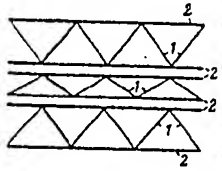


FIG. 8

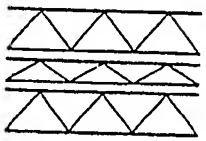


FIG. 9

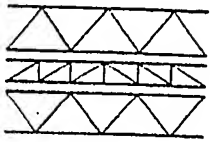


FIG. 10

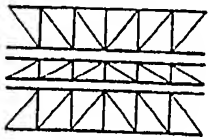


FIG. 11

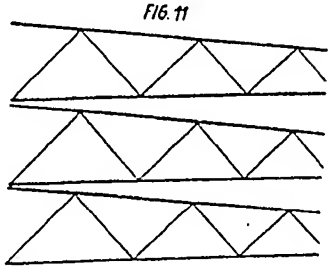


FIG. 12

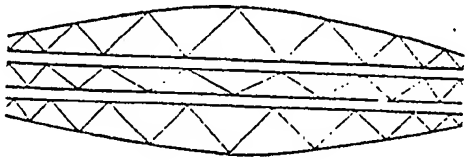


FIG. 13

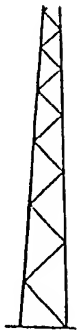


FIG. 14